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ABSTRACT

Student satisfaction with distance education instruction was assessed in the context of slow scan interactive television between two university campuses and between a university campus and a business location. The three studies focused on graduate level courses. The research questions addressed were: (1) Is the level of student satisfaction with the distance education course consistent throughout the semester? and (2) Are there differences in the level of student satisfaction between students in a "live" instructional setting and students at a remote instructional setting? The assessment survey was organized into three dimensions: instruction/instructor characteristics, technological characteristics, and course management and coordination. Results indicated that the level of student satisfaction tended to increase as the semester progressed in each of the three advanced graduate courses and that the "live" setting was favored over the remote setting on only one (technological characteristics) of the three dimensions for only one of the courses. Overall, student satisfaction was rated near or above a four on a five-point scale. Eleven figures and 13 tables provide survey information. (Contains 17 references.) (AEF)

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Factors Associated with Student Satisfaction in Distance Education Using Slow Scan Television

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Presented at
Annual Meeting of the American Educational Research Association
San Francisco
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Factors Associated with Student Satisfaction in Distance Education Using Slow Scan Interactive Television

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The assessment of student satisfaction with distance education instruction was conducted in the context of slow scan interactive television between two university campuses and between a university campus and a business location. The research questions investigated were (1) Are there differences in the level of student satisfaction with distance education courses as the semester progresses? and (2) Are there differences in the level of student satisfaction between students in a "live" instructional setting and students at a remote instructional setting?. Evidence found relating to the first question was that the level of student satisfaction tended to increase as the semester progressed in each of three advanced graduate courses. In relation to the second question, evidence was found that significantly favored the "live" setting over the remote settling on only one (i.e., technology characteristics) of three dimensions for only one of two advanced graduate courses. Overall, student satisfaction was rated near or above a four (i.e., good) on a five-point scale for each of three dimensions (i.e., instruction/instructor, technology, and course management) in each of three advanced graduate courses.

Factors Associated with Student Satisfaction in Distance Education Using Slow Scan Interactive Television

Distance education courses using television in the recent past rarely occurred in schools of education, rather in a different building, across campus in a television studio. Faculty may have done it themselves, we all know faculty who have done it; but distance education has not been done on a daily basis. Interaction with a community of skilled professionals originally schooled in the tradition of commercial broadcast television was required.

Distance education has changed, but not perceptions. The new era of interactive two-way video and audio transmission and it's accompanying technology has required a paradigm shift. It is now possible to originate a distance education class from a room down the hall from any professor. The system does not require technicians, directors, or scripts, but does require that the professor dial a phone number to establish the connection. Professors are exploring this new medium and testing it. Can you accomplish what you can in your regular class? What are the constraints? What are the possibilities? What works? What doesn't?

This paradigm shift is a fundamental change. Gehlauf, Shatz, and Frye (1991) state that technologically delivered distance education courses is one of the most significant changes to occur recently in higher education. We are in an era parallel to the massive revolution in desk-top computing in the 1980's. Schmit (1994) states that videoconferencing technology (i.e., similar to the technology used in this study) is booming. In the near future, it is projected that systems will be much lower in cost, sales will sharply increase, and systems will be improved. There is a grass roots movement of educators emerging. We are exploring the possibilities of technological substitution applied to our traditional course offerings. What are the implications? Is the quality of instruction maintained? Learning and attitudes of participating students are at a level that it makes no difference whether the course is received in the traditional format or whether it is received in this technological environment. The focus of this study is the impact on student satisfaction since it is the students who are the recipients of the instruction.

In this project, the assessment of student satisfaction toward televised instruction for use in the School of Education distance education classrooms was conducted in the context of interactive (two way) video/audio communication between the Indiana University, Bloomington (IUB) campus and the Indiana University-Purdue University, Indianapolis (IUPUI) campus or a business site located in Kokomo, Indiana. At the core of the communication link was compressed video technology utilizing a CODEC at each classroom for transmission of digitized images over two existing telephone lines already in place and available between the two campuses. Using PictureTel 4000 systems at a bandwidth of 112 kb/s, commonly referred to as slow scan compressed

video, graduate courses were conducted and were the context of the series of studies in this project. The IUB PictureTel system includes a camera, echo cancellation, 3-way camera control system, and switching devices. It was supplemented with an auxiliary camera/cameraman control system, document camera, vcr, 3 Proscan 35" monitors, and a 486/66 computer so that the instructor had a choice of five video sources to send to the remote site. At the IUPUI location, the equipment was similar except there was no computer. The equipment at the Kokomo site included only the basic PictureTel equipment comprised of the CODEC, a monitor, a document camera, the main camera, and the control keypad. Students and instructors involved in a compressed video session have the ability to simultaneously observe (video) and listen (audio) in an interactive environment while they share any of the images. This interactive video equipment was supplemented with telephones and FAX machines located in the classrooms at all three sites.

There were analytical questions centrally embedded in this assessment effort that emerged from previous research. The questions were (1) Are there differences in student satisfaction with these distance education courses as the semester progresses? and (2) Are there advantages/disadvantages for students at the site of origin or at the remote site? This presentation is a summary of three research studies exploring the use of slow scan compressed video in distance education instruction with two-way audio and video similar to the technology used by NASA to transmit video from the astronauts in space. The findings for each study are presented separately followed by a comparison and contrast of the studies in the discussion and conclusions.

During the spring 1993, the School of Education at Indiana University-Bloomington (IUB) and at Indiana University-Purdue University-Indianapolis (IUPUI) installed equipment in distance education classrooms for courses and special sessions. These classrooms support interactive two-way video and audio using either full motion video, similar to commercial broadcast television, or compressed video. Full motion video refreshes the screen at a rate of 30 frames per second, while compressed video typically refreshes the screen at rates between 10-15 frames per second.

Presently, there is a significant cost differential between full motion and compressed video technologies, clearly favoring compressed video at $26 per hour of connect time. The design of the user interface for compressed video is also superior. A connection is established with a phone call to the equipment at the other site. The selection of five video sources: three cameras, a VCR, and computer are controlled by a keypad. The keypad also controls the selection of the preset camera shots with pan, tilt, and zoom keys. It also allows control of similar features at the remote site. For these reasons the Indiana University School of Education began offering courses using compressed video in the summer, 1993.

Previous studies of the effectiveness of compressed video in distance education

utilized greater bandwidth where the video images more closely resembled broadcast quality television. Farr and Muscarella (1991) reported the results of a study comparing the amount of interactivity generated in three different instructional settings: face-to-face instruction in a television classroom, real time instruction via microwave (two-way interactive video), and audio teleconference instruction supplemented with prerecorded videos. Using a between group design and full motion video transmissions, they concluded that the presence of the instructor, regardless of site, increased the amount of interaction. It was clear that having the instructor in the same room had a positive effect on the quality of interaction.

Gehlauf, Shatz, and Frye (1991) stated that there has been an acknowledgment on the part of investigators that when it comes to instructional techniques, there is a difference between face-to-face instruction and interactive televised instruction. They cited Carl (1986), Chute, Balthazar, and Poston (1988), and McCleary and Egan (1989). They pursued what constituted effective instruction in the traditional classroom and whether it was the same as what constituted effective instruction in an interactive television classroom. A questionnaire survey of faculty was conducted in the context of a microwave network (i.e., full motion). They found that faculty wanted a training program in order to learn how to interact with their remote site students.

Based on a study that alternated instructors and operating at a bandwidth of a full T1 (i.e., equivalent to 24 phone lines) across sites, Miller et al. (1993) investigated whether interaction with the instructor was curtailed in the remote setting even though the technical capacity for such interaction was available. They also pursued whether students in the remote setting were apt to be as attentive as their "live" setting counterparts. They found that students did not feel that their mastery of the content was as adequate when the professor was in the remote setting as in the "live" setting, a difference that was significant ($p < .01$). A similar result was found with regard to the students feeling a part of the class interaction with the professor.

Ritchie and Newby (1989), using a between group design and one way video two way audio, compared three groups on classroom interaction. One group was a traditional face-to-face classroom, a second group was a studio classroom, and a third group was in a distance education classroom equipped with two-way audio situations. They found that students in the traditional classroom interacted twice as often as the combined total of studio and distance groups. They concluded that distance students experienced less involvement, less ability to ask questions, and less overall enjoyment. They suggested using supplementary strategies to compensate for limitations of the communications systems. However, the context of this study varied from the context of interactive television.

In contrast to the findings from these studies which found instructional disadvantages for interactive television, the benefits of providing courses supported with compressed

video technology are well documented. For example, (1) reduction of travel time and costs for both students and instructors, (2) increased number of students served, (3) expanded or shared resources and expertise among sites, (4) improved speed and accuracy of responses to questions or problems at remote sites, (5) provision for the maintenance of the potential for instructor/student interaction, and (6) utilization of existing transmission lines with associated reduction in costs have been suggested as advantages for the adoption of the technology (Hakes et al., 1993; Miller et al., 1993).

Research Questions

This presentation summarizes the results of three studies (Pugh et al., 1993, and Pugh and Siantz, 1994) conducted to assess the efficacy of the compressed video technology in instruction, by assessing the level of student satisfaction with courses offered in the distance education classrooms. Each study focused on a graduate level course. Collectively the studies addressed the same primary research questions. As stated earlier, the questions were (1) Is the level of student satisfaction with the distance education course experience consistent throughout the semester?, and (2) Are students at the site of "live" instruction more satisfied with the experience than their counter parts at the remote site?

Instrumentation

For all three studies, a common instrument was used which was an empirically-based assessment survey that had been developed and validated in a distance education setting by Biner (1993). This instrument was organized into three dimensions and had been refined through both a content validation study and a factor analytic study (Biner et al., 1994). The dimensions identified were (1) instruction/instructor characteristics, (2) technological characteristics, and (3) course management and coordination. These three dimensions were similar to the dimensions found in other existing instruments such as the one developed by Harrison et al. (1991). A total of 22 items across the three dimensions were judged relevant to this distance education setting. The instruction/instructor dimension consisted of 13 items and had a reliability of .84 (alpha) for these studies. The technology characteristics dimension consisted of 5 items (reliability =.69) and the course management and coordination dimension consisted of four items (reliability=.63).

Study 1: Summer 1993

Context: The first of the three studies involved the first course offering using the distance education classrooms in the School of Education at Indiana University. It was a graduate level course. IUB and IUPUI campuses were the sites with students at both sites. The instructor of record was a senior faculty member who alternated teaching at the two sites. The course was team taught with an instructor from the IUPUI campus. The instructor of record had taught the course for several years. The two instructors controlled the cameras.

Data Collection Methods: Subjects for this study were students enrolled in an advanced graduate course with six students enrolled at IUB and nine students enrolled at IUPUI. Characteristics of one of the data collection techniques included (1) the site of origin for the senior instructor alternated between IUB and IUPUI on a per class basis, (2) data were collected using an existing instrument (Biner, 1993) which was administered four times during the semester, and (3) all data were collected by having students select an alias name to use throughout data collection steps assuring anonymity of responses. The instrument was administered four times, twice early in the semester which were combined for analysis purposes and twice late in the semester also combined for analysis purposes. The locations of the student and instructor were coded and the variables combined to identify whether the student was receiving "live" or remote instruction.

A second data collection technique was based on an observer's comments who attended each class session. At least one member of the research team recorded anecdotal comments related to class proceedings using a laptop computer during each class session. Coding included instructor location and observer name. A time signature in half hour increments identified individual comments. These observations were shared with the instructor after each class session and were subsequently used in the data analysis.

A third data collection technique consisted of distributing a 3 x 5 index card to each student at each class session. Students were asked to write both positive and negative comments on the card. They were asked to report their reactions to issues related to class material, instructor presentation, and to the impact of technology on the class session. The cards provided feedback to the instructor after each session and served as a third source of information for data analysis. Each statement related to technology was coded as positive or negative. When a student made several statements on one card, each was coded.

Results: In general, students rated the distance education experience as being "good". Individual survey items ranged from 3.5 (between "average" and "good") to 4.6 (between "good" and "very good"). The analyses of the data related to the first research question revealed that student satisfaction with the technology increased as the semester progressed (See Table 1). The mean late in the semester (4.16) was significantly [$F(1,8) = 11.01$, $p < .01$] higher than the mean early in the semester (3.79).

Table 1: Study 1 - Question 1 Early/Late Dimension Mean Scores

Dimensions	Early	Late	p
Instruction & Instructor	4.12	4.23	> .05
Technology	3.79	4.16	< .01
Course Management	3.97	3.95	> .05

When viewing individual student responses for the instruction/instructor dimension and the course management dimension approximately half the students indicated some improvement over the semester while half were not as satisfied. In contrast, 75 percent of the students were more satisfied with the technology by the completion of the course.

Table 2: Study 1 - Question 2 Live/Remote Dimension Mean Scores

Dimensions	Live	Remote	p
Instruction & Instructor	4.19	4.19	> .05
Technology	3.96	4.00	> .05
Course Management	3.86	4.05	> .05

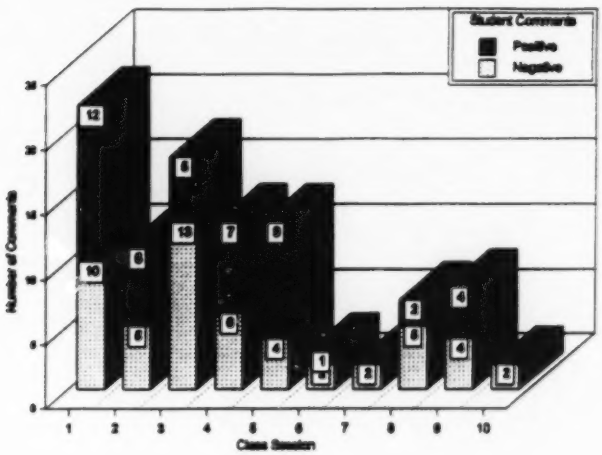
The second analysis focused on students receiving "live" instruction compared to those at the remote location. The dimension means ranged from 3.86 to 4.19 (See Table 2). There were no statistically significant mean differences ($p > .05$) in satisfaction between the students receiving "live" instruction and students at the remote site.

The impression of the two observers was that the "action" was at the instructor's site. There were more instructor-student interactions, and more student to student interactions at the "live" instruction location. While this is true, since student presentations took place at each site, the distinction between a "live" and remote site became blurred. The student interaction between sites was good, it increased for about half of the course, then declined. The technology is not equally appealing to all students. During informal conversations with students, it became apparent that two students would have preferred a traditional course. When asked about the technology they answered, "It's O.K., but...".

A question central to this study was whether student satisfaction was different between students receiving "live" instruction and students at the remote site. Observer data indicated that there were more student-to-instructor interactions and student-to-student interactions when the instructor was at the site. It sensitized the instructor to both the instructional needs of the students, and technical modifications. A trend in observer data was that the instructor and student interaction between sites increased for much of the course which was, in part, due to the instructor changing locations.
Initially, at least one student did not understand why the showing of students at the remote site was important.

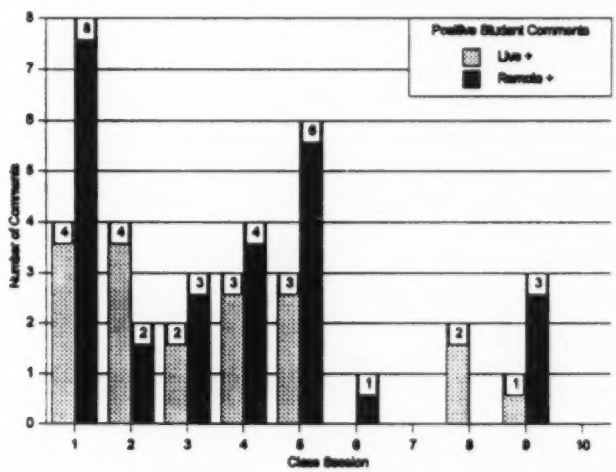
In reviewing the data reported for student comments in Figure 1, certain trends became apparent. The number of comments declined over the length of the course. The peak of negative comments occurred during the third session. By the fifth session,

Figure 1 Study 1 Positive & Negative Student Comments by Class Session



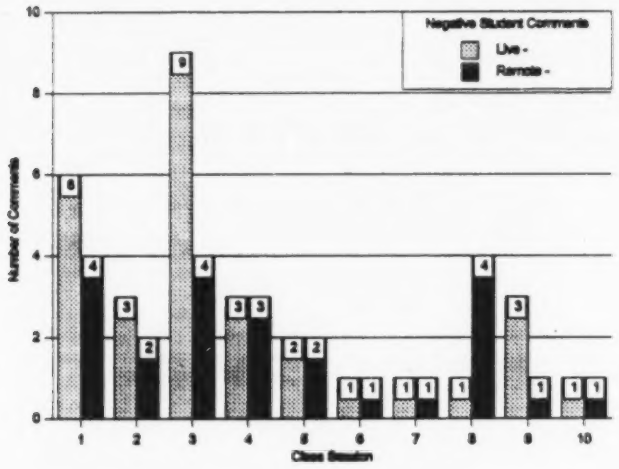
students were making more positive than negative comments. There was some evidence of dissatisfaction with the room arrangements (desk position, sound, and lighting) for several sessions near the end of the semester. In reference to Figure 2, students at the remote site offered more positive comments in six of the ten sessions. At the remote site, the number of positive comments decreased dramatically after the

Figure 2 Positive Comments by Setting and Class Session



first session, increased as students began class presentations in session three through five. Student presentations continued throughout the course. Students varied in their skill with the equipment and their sophistication in presenting, and this appears to be reflected in the data. In Figure 3, illustrating the number of negative comments, the start of the student presentations at session three is noticeable with a high number of negative comments. The negative comments declined to one per site in sessions six to ten. Sessions eight and nine generated an increase in the negative comments when there were minor equipment problems.

Figure 3 Study 1 Negative Comments by Setting and Class Session



At the beginning of the course, one student at IUB said that the pictures of the remote site "don't add anything". Positive statements across sessions followed the theme of constant improvement. By the fourth session the students made statements that included "Smooth operation of technology" and "use of equipment much better". Nevertheless at least one student as late as the ninth session said "The technological aspects of the class are still somewhat distracting". However this type of comment tended to be in the minority.

Study 2: Fall 1993

Context: This was a study of a graduate level course offered across the IUB and

IUPUI campuses with students at both sites. There was one instructor who was a senior faculty member who had taught the course for several years. The instructor alternated teaching between the two sites. Two graduate student assistants, one at each site, controlled the cameras. There were six students at IUPUI and 15 students at IUB.

Design: A three factor split plot factorial design consisting of one between subject factor (student campus: IUB or IUPUI), and two within subject factors (campus of instructor origination: IUB or IUPUI; and, time: early or late in the semester) was used. Student responses from early in the semester (i.e., first two sets) were combined and classified as "early" while the last two response sets were combined and considered "late". A second trend suggested by the questions was whether student responses were different between students at the remote site who were very dependent upon the interactive television for instruction and students who received "live" instruction with the instructor present.

Data Collection Methods: Characteristics of the data collection included (1) the site of origin for the instructor alternated between IUB and IUPUI on a per class basis, (2) data were collected using an existing instrument (Biner, 1993), and (3) all data were collected by having students select an alias name to use throughout data collection steps assuring anonymity of responses.

Complementary data collection strategies to the measurement of student satisfaction were used to assist in the interpretation of results from the survey. The second strategy was to have an observer maintain a record of activities related to the interaction of the instructor and students with the technology during an instructional session. They served as a record of special events that might relate to differences among student responses. The third strategy was the collection of open ended comments from students using 3 x 5 cards. Students were asked to write their comments on how they thought the class proceeded. The results from these two strategies were recorded for each class session. The observer notes and student comments were classified into favorable or unfavorable responses and coded into categories suggested by the analytical questions.

Results: Each item in the student satisfaction survey used a five-step scale of very good (5 points), good (4 points), average (3 points), poor (2 points) and very poor (1 point). The instruction/instructor characteristics dimension, which consisted of 13 items, received an average item response of 4.4 which reflected a rating about midway between good and very good. The technology characteristics dimension, which consisted of 5 items, had an average item response of 3.8 which indicated a rating above average, very near a rating of good (i.e., 4.0). The course management/coordination characteristics dimension, which consisted of 4 items, had an average item response of 4.3 which indicated a rating between good and very good.

All of the average item ratings were above 3.5 indicating that the average response was well above average. For 15 of the 22 items the mean rating was above 4.0 indicating a rating between good and very good. There was an indication that overall the students rated their level of satisfaction as good to very good in regard to the instruction, the technology, and the course management.

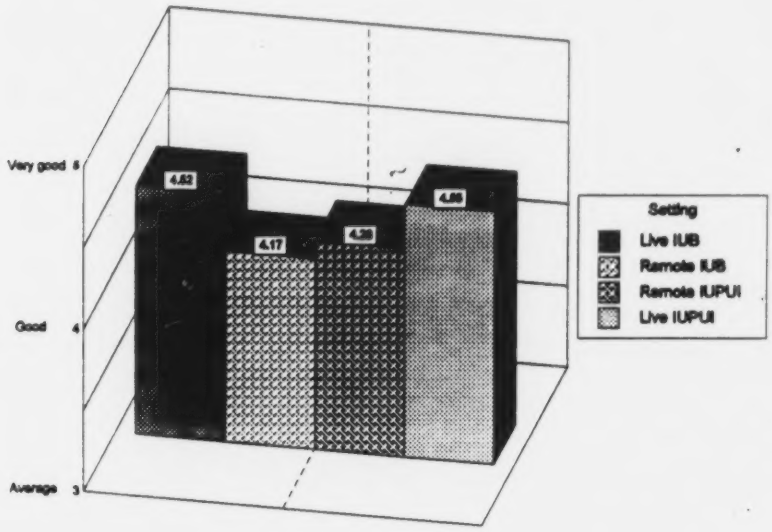
Table 3: Study 2 - Question 1 Early/Late Dimension Mean Scores

Dimensions	Early	Late	p
Instruction & Instructor	4.37	4.46	> .05
Technology	3.58	3.98	< .01
Course Management	4.27	4.38	> .05

There was a significant main effect for time [F(1,18)=10.90, p < .01] for the technology dimension. The mean (3.98) later in the semester after the students were experienced with the technology was significantly higher than the mean (3.58) earlier in the semester.

For the instruction/instructor characteristics dimension, a significant interaction [F(1,13)=6.43, p < .05] consistent with observer comments and open ended responses

Figure 4 Study 2 Instructor/Instruction Mean Scores by Setting

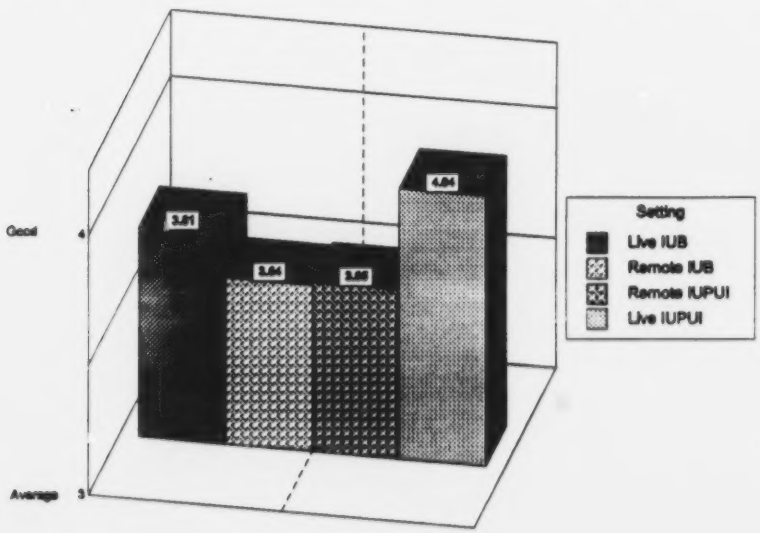


of the students was found. The [instructor campus]-by-[student campus] interaction was statistically significant with means (4.52 and 4.55) that were higher when the two locations were the same (i.e., "live" instruction) than the means (4.17 and 4.28) when

the two locations were different (i.e., "remote site" instruction). No other differences were found to be significant for this dimension.

The [instructor campus]-by-[student campus] interaction was also statistically significant [$F(1,18)=6.91$, $p < .05$] for the technology characteristics dimension. The means (3.81

Figure 5 Study 2 Technology Mean Scores by Setting



and 4.04) were higher when the two locations were the same (i.e., "live" instruction) than the means (3.64 and 3.65) when the two locations were different (i.e., instruction at the remote site).

In summary, the means aggregated across the two "live" sites and the two remote sites are reported in Table 4.

Table 4: Study 2 - Question 2 Live/Remote Dimension Mean Scores

Dimensions	Live	Remote
Instruction & Instructor	4.53	4.23
Technology	3.91	3.65
Course Management	4.35	4.31

As is evident in Table 4, the means from the "live" settings are consistently higher than the means from the remote settings. For the instructor/instruction and technology dimensions, the trends were consistent with the significant interaction findings reported in Figures 4 and 5.

The student comment data presented in Figure 6, is similar to the first study in that the

Figure 6 Study 2 Positive & Negative Comments by Class Session

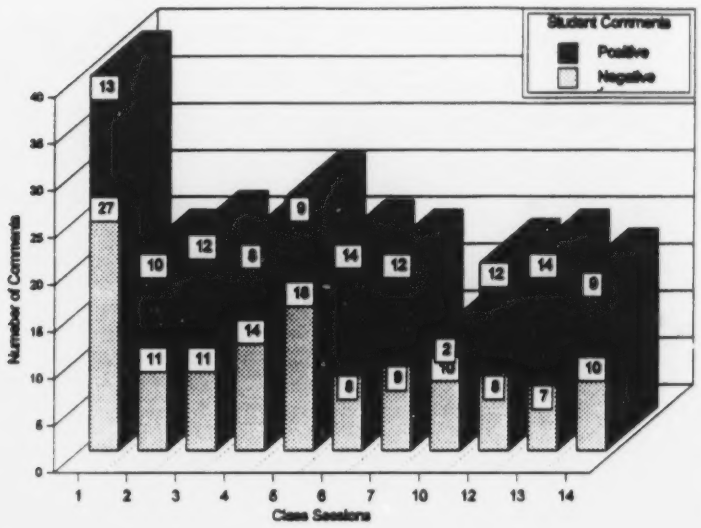
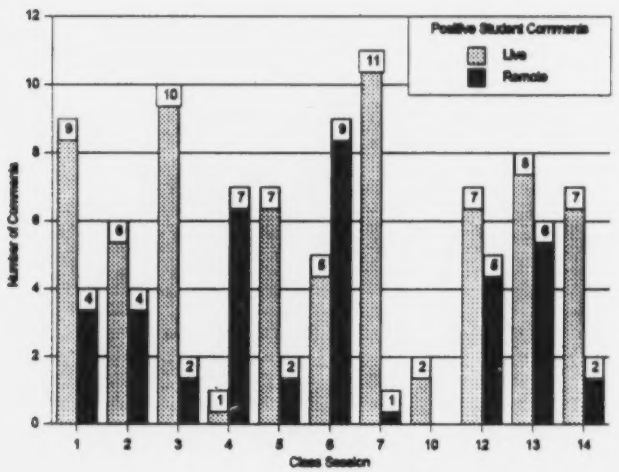


Figure 7 Study 2 Positive Comments by Setting and Class Session



negative comments declined over time. Negative comments reached a peak in session five. Observer notes document that a new sound system was installed during the semester. There were peaks during the sessions when the new equipment was fine tuned, and when some students made presentations.

In Figure 7, the comments are distributed by setting across class sessions. In nine out of eleven sessions the number of positive comments at the "live" site were greater than at the remote site. This is consistent with the findings from the student satisfaction survey instrument.

In reviewing the negative comments, Figure 8, the largest number of comments occurred during the first class session at the "live" location. For six of the eleven class sessions there were a greater number of negative statements from the "live" setting, and conversely for five of the eleven sessions the trend was reversed in favor of the remote setting. Based on these findings no consistent trend was identified.

Figure 8 Study 2 Negative Comments by Setting and Class Session

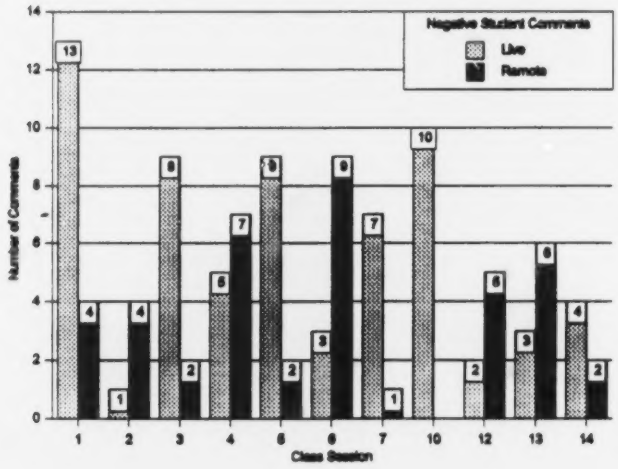


Figure 8 displays the frequency of comments by student in the "live" or remote setting. Both the bars representing the "live" and remote condition demonstrate a pattern of pronounced fluctuation in the number of comments generated per session. The instructor alternated the site of instruction throughout the course.

Study 3 Summer 1994

Context: This was a study of a graduate level course which originated at IUB for a class located at a remote business site in Kokomo, Indiana. The course was part of an experimental off-campus Masters degree program taught by an instructor who was a senior level faculty member . It was the first time the course had been offered. There were no students with the instructor at the IUB site where all sessions originated. There was a resident faculty member serving as a facilitator at the remote site in Kokomo. Both the remote site facilitator and the instructor controlled the cameras at the remote site. The remote site classroom was a conference room with a large table. The room had one monitor and one document camera. There were many times when several students were off camera.

Data Collection Methods: The data were collected from 16 students enrolled in a graduate course during a regular academic summer session. Characteristics of the data collection included (1) the site of origin for the instructor was IUB, the students were at a business location off-campus. (2) data were collected using an existing instrument (Biner, 1993), and (3) all data were collected by having students select an alias name to use throughout data collection steps assuring anonymity of responses. The instrument was administered twice, once early in the semester and once late in the semester. Unlike the previous studies reported, there were no observer notes or student comment cards.

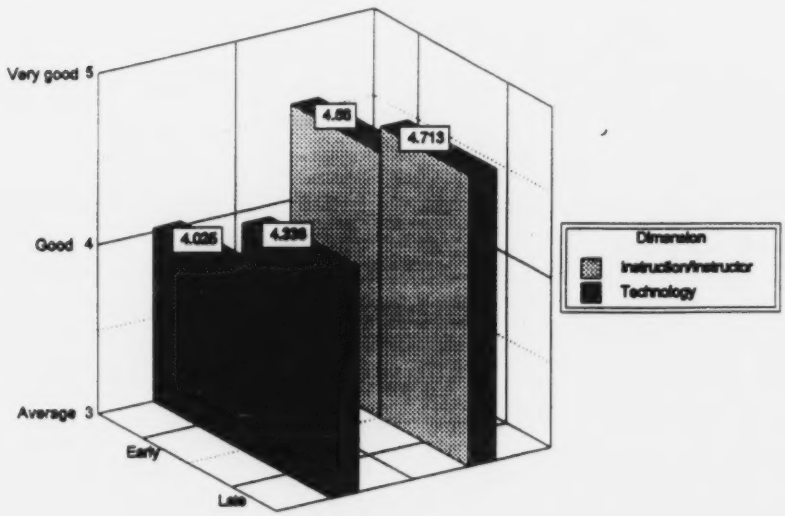
Results: The item mean scores ranged from two items at 3.8 with seventeen items above 4.5, and the remainder of the items between 4.0 and 4.5 The majority were above the "good" level. The three dimension mean scores were all above 4.0. The data presented in Table 5 indicate that there were statistically significant results. The students rated the instructor/instruction dimension ($F = 19.91$, $p < .01$), and the technology dimension ($F = 19.75$, $p < .01$) higher during the second half of the course.

Table 5: Study 3 - Question 1 Early/Late Dimension Mean Scores

Dimensions	Early	Late	p
Instruction & Instructor	4.56	4.71	< .01
Technology	4.03	4.34	< .01
Course Management	4.44	4.63	> .05

Figure 9 illustrates these findings.

Figure 9 Study 3 Question 1 Dimension Mean Scores by Time



When translating these findings to individual students, 69 percent of the students scored higher on the instruction/instructor dimension during the second half of the semester, only one student scored lower, two felt it stayed the same, and two were missing. For the technology dimension, over 80 percent of the students indicated a higher level of satisfaction with the technology as the semester progressed, while two were more dissatisfied.

The third study did not have students at the site where the instruction originated. The dimension mean scores reported in Table 6 for course management and instruction/instructor were above 4.5 between "good" and "very good" (4.53 and 4.64, respectively).

Table 6: Study 3 - Question 2 Remote Dimension Mean Scores

Dimensions	Live	Remote
Instruction & Instructor	na	4.64
Technology	na	4.18
Course Management	na	4.53

The technology dimension was rated as slightly higher than "good" (mean = 4.18).

Discussion

The dimension mean scores for the studies are presented in Table 7. All of these scores were in the range 3.78 (above "average" slightly below "good") to 4.64 (between "good" and "very good"). The instructors were experienced senior level faculty, this factor probably contributes to the high ratings on the instruction/instructor dimension. The scores on the technology dimension approach the "good" level of the scale.

Table 7: Dimension Mean Scores by Study

	Mean Scores		
Dimension	**Study 1**	**Study 2**	**Study 3**
Instruction & Instructor	4.19	4.39	4.64
Technology	4.00	3.78	4.18
Course Management	3.96	4.33	4.53

Study 2 had the largest number of students at both sites, and the lowest score on technology. Study 3 had the highest score on that dimension. It was a new course and the instructor had no prior teaching materials or style to modify for the distance education setting.

Figure 10 Dimension Mean Scores by Study

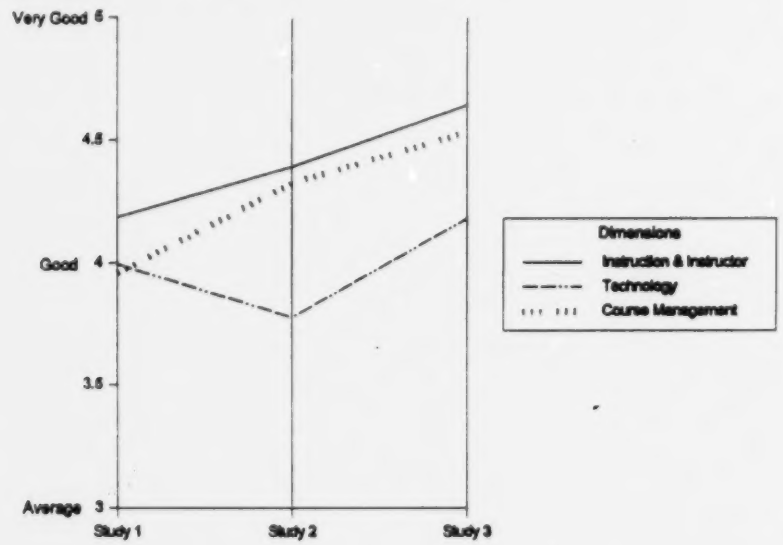


Figure 10 is a plot of each dimension mean score for the three studies. The studies are presented in chronological order. There appears to be improvement over time. The

exception is with the technology dimension for the second study. The School of Education was continually refining the distance education technologies used in the classrooms. During the second study a new audio system was installed, with speakers and microphones ceiling mounted. For several class sessions there was experimentation with volume control and echo cancelling. This may have contributed to the lower ratings on the technology dimension.

Research Question 1

The first research question addressed student satisfaction over the duration of the course. Each of the three student satisfaction survey instrument dimensions were analyzed in relation to student ratings from the first part of the semester contrasted to their ratings during the second half of the term. The means reported in Table 8 illustrate a tendency for student satisfaction to increase over the semester. However, only Study 3 is statistically significant. The students rated the instructor/instruction dimension higher during the second half of the course ($F = 19.91$, $p < .01$).

Table 8: Satisfaction with Instruction/Instructor During Semester

	Early	Late	p
Study 1	4.12	4.23	> .05
Study 2	4.33	4.46	> .05
Study 3	4.56	4.71	< .01

The student satisfaction toward the technology increased during the semester. Table 9 illustrates that this trend began with the first study ($F = 11.01$, $p < .01$) and was replicated in the second ($F = 10.90$, $p < .01$) and the third ($F = 19.57$, $p < .01$) studies. The items in this dimension included the quality of the video image and sound, as well as assessing the stability of the technological environment. Observers present in these courses, indicated that the students began rapidly adjusting to the use of the technology, and appeared to be comfortable using it by the third class session. For the student comment data from Study 1 and Study 2, there was a general decrease in all comments as students became sensitized to the technology.

Table 9: Satisfaction with Technology During Semester

	Early	Late	p
Study 1	3.78	4.16	< .01
Study 2	3.58	3.98	< .01
Study 3	4.03	4.34	< .01

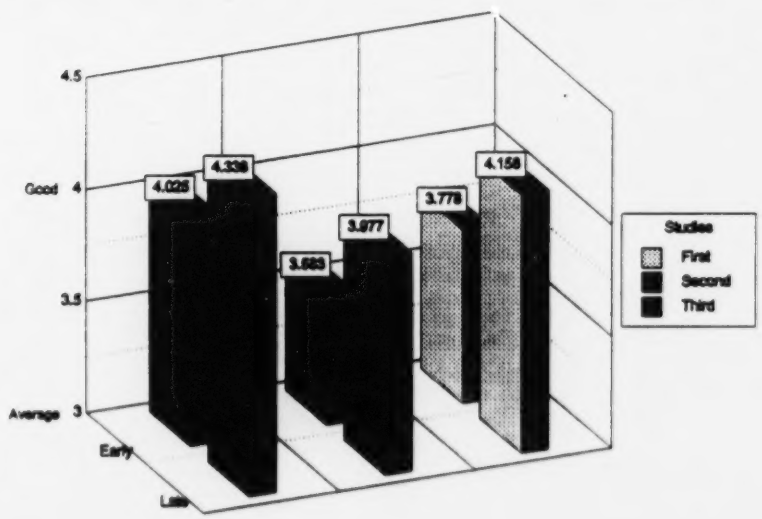
These findings indicate that there is a period of adjustment to using these types of distance education technology. Although, one or two students per class had a previous distance education experience, the experience had been using one-way full motion

video with telephone communication. This was the first experience for all of the students with a slow scan, two-way audio and video system.

The students were more than passive observers of the instructor using the technology. Each course featured individual and group presentations which required that the students use the camera controls, and the document camera. Activities included "reporting out" sessions from small group work, presentation of theoretical models, case studies, role plays, and "student run" learning activities. The courses required that the students develop at least rudimentary skills in preparing graphics, although their figures and text were frequently hand written.

Since the third study had students only at the remote location, the students were entirely dependent on the technology for receiving instruction. Their reported level of satisfaction early in the semester was "good" and it improved later in the semester. Figure 11 illustrates that while the highest student ratings for technology occurred in the third study, the gains for the first and second studies were more dramatic, and they were similar. Studies 1 and 2 each had students at a "live" instruction setting and a remote instruction setting.. The instructor or facilitator (i.e., instructor, graduate assistant, student) had more complex decisions to make about how to use the technology by weighing the needs of both the students at the origin site as well as the remote site.

Figure 11 Satisfaction with Technology During Semester



For each of the studies student satisfaction with the course management dimension appeared somewhat stable for the duration of the class as reported in Table 10. There were no statistically significant findings. The mean scores for the second and third studies increased slightly during the course.

Table 10: Satisfaction with Course Management During Semester

	Early	Late	p
Study 1	3.97	3.95	> .05
Study 2	4.27	4.38	> .05
Study 3	4.44	4.63	> .05

Research Question 2

The second research question focused on whether the students were better satisfied with "live" instruction, than with instruction from a distance. This question was specifically addressed in Study 1 and Study 2 in which the instructor alternated teaching between the two sites. In terms of the instruction/instructor dimension, in Table 11, the results were mixed. In Study 1 there was not a statistical difference, the means were approximately equal. The second study identified that the students in the "live" setting were more satisfied than those students at the remote site.

Table 11: Student Satisfaction with Instruction/Instructor by Setting

	Live	Remote	p
Study 1	4.19	4.19	> .05
Study 2	4.53	4.23	< .05
Study 3	na	4.64	na

The class size may have contributed to this effect. In Study 2 there were more students at both sites. It is easy for the students at the site of origin to dominate conversations, and for them to get the attention of the instructor. This was particularly true in lively discussions.

In each of the studies the students rated the instruction/instructor at slightly above the "good" level of the five point scale. It is interesting to note that the highest rating 4.64 are from the students at a remote location in the third study. Since the students in the other studies had the opportunity of participating in both "live" and remote instruction, it could be argued that the students in the third study did not have a reference for judging the instruction and may have used a different frame of reference such as in comparison to no course being offered that was available to them.

The satisfaction with the technology, Table 12, again portrays mixed results. In the first

study there were no significant findings. In the second study, the students when experiencing "live" instruction were more satisfied with the technology. This finding is supported by the student comment data from Study 2. Students at the "live" site made more positive comments in nine of the eleven class sessions than students at the remote site. Perhaps the technology was less noticeable when the students were at the site of origin.

Table 12: Student Satisfaction with Technology by Setting

	Live	Remote	p
Study 1	3.96	4.00	> .05
Study 2	3.91	3.65	< .05
Study 3	na	4.18	na

In reviewing the results for course management in Table 13, there were no significant differences in any of the studies.

Table 13: Student Satisfaction with Course Management by Setting

	Live	Remote	p
Study 1	3.86	4.05	> .05
Study 2	4.35	4.31	> .05
Study 3	na	4.53	na

Summary and Conclusions

The analytical questions centrally embedded in this assessment effort emerged from previous research. This summary and conclusions section addresses these questions.

(1) Are there differences in student satisfaction with these distance education courses as the semester progresses?

Student satisfaction did improve over time. The means were greater at the end of the semester in eight of the nine study-by-dimension comparisons. Four of the comparisons were significant at the $p < .01$ level. They were: instruction/instructor dimension Study 3, and the technology dimension of all three studies. Additionally, the number of student comments declined during the semester in Study 1 and Study 2.

(2) Are there advantages/disadvantages for students at the site of origin or at the remote site?

Although evidence from the observer comments and student comments tended to support that there was more interaction between the instructor and students and between students at the "live" site, the student satisfaction survey data did not consistently support this trend. The only significant difference between "live" and remote setting means was found with the technology dimension for Study 2. In this comparison, the mean from the "live" setting was significantly higher than the mean from the remote setting. For Study 3, this comparison was not possible because only students at the remote site were present. However, the means from Study 3 were the highest of the three studies and argues against the trend of an advantage for the "live" setting.

In relation to previous research, Miller et al. (1993), Farr and Muscarella (1991), and Ritchie and Newby (1989) reported evidence that there was an advantage for the "live" setting. In this set of studies the evidence was mixed with observer comments and student comments supportive of the trend as well as one of the two studies on the technology dimension. However, special instructional styles were present in these two studies that involved an extensive amount of student presentations in both studies that may have blurred the difference between "live" and remote settings.

These three studies all involved senior faculty who were highly experienced with teaching advanced graduate courses before offering courses in a distance education setting. All three instructors used a teaching style that was activity based and student centered, a style that takes advantage of the interactive nature of the technology (Siantz and Pugh 1994, and Pugh et al. 1994). They were all three volunteers who reported that they devoted more time to class preparation in this setting and were highly motivated to make the experiences for the students a success. All three faculty were willing to devote sufficient time to training to prepare themselves to handle the variety of demands of the new setting. The general trend of high means on all dimensions that were near or above a scale value of four on a five point scale may have been reflective of the quality of the instruction which these faculty were accustomed to providing. Regardless, the means can be interpreted as meaning that the student's level of satisfaction with the courses was rated as "good" or better.

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